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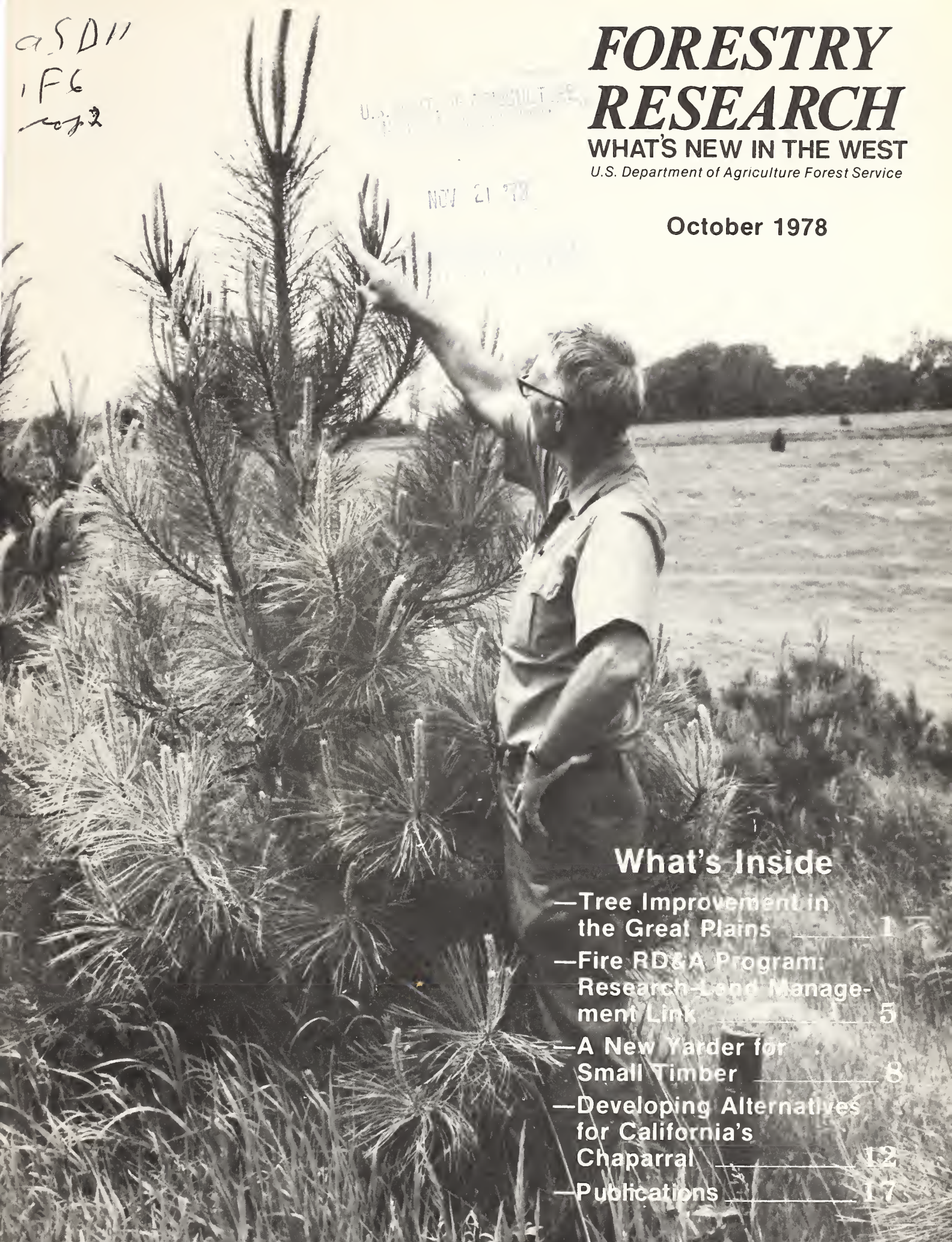
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# FORESTRY RESEARCH

WHAT'S NEW IN THE WEST

U.S. Department of Agriculture Forest Service

October 1978



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## a note to you

*Forestry Research: What's New in the West*, is a report on the work of the USDA Forest Service's four Forest and Range Experiment Stations in the West. These research centers, and the States included in their areas of study are: Rocky Mountain (North Dakota, South Dakota, Nebraska, Kansas, Colorado, Arizona, New Mexico, and part of Wyoming, Oklahoma, and Texas); Intermountain (Montana, Idaho, Utah, Nevada, and part of Wyoming); Pacific Northwest (Alaska, Oregon, and Washington); and Pacific Southwest (California, Hawaii, and the Pacific Basin).

## on the cover

Research Forester Ralph Read examines ponderosa pine in provenance studies at the Horning Tree Farm in Nebraska. Read about these studies on the facing page.

## our addresses

Single copies of most of the publications mentioned in this issue are available free of charge. When writing to research stations, please include your complete mailing address (with ZIP) and request publications by author, title, and number (if one is given)

For INT publications write:

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Range Experiment Station  
507 25th Street  
Ogden, Utah 84401

For PNW publications write:

Pacific Northwest Forest and  
Range Experiment Station  
Post Office Box 3141  
Portland, Oregon 97208

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Pacific Southwest Forest and  
Range Experiment Station  
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# Tree Improvement in the Great Plains



*Research Technician John Sprackling pollinating a select Scots pine provenance tree to produce progenies for its genetic evaluation and for recurrent selection and second generation seed orchard.*

**T**rees seldom exert a greater influence upon man's environment and well being than in regions where they do not occur naturally or where they are difficult to establish or maintain. It is for these reasons that trees are appreciated and valued so highly in the Great Plains of North America.

The Plains, a vast agricultural region in the central part of the nation, are characterized by environmental extremes—strong winds, limited precipitation, abrupt temperature changes, blizzards, and recurring cycles of drought. The environmental factors acting against the survival and establishment of trees are so rigorous throughout most of this region that natural stands are restricted, mainly, to bottom lands along streams and drainageways.

While the number of deciduous species native to the Plains may be adequate, there is a scarcity of coniferous species—only the junipers attain widespread distribution. Because of their long-life, beauty, and ability to provide year-round protection for man, animals, and crops, the conifers are very popular and are in high demand by farmers, ranchers, wildlife biologists, and urban dwellers.

Researchers with the Rocky Mountain Station at Lincoln, Nebraska, and Bottineau, North Dakota, are testing and evaluating introduced and native species for wider use in



the Great Plains. They are selecting, breeding, progeny testing, and establishing seed orchards to develop genetically improved trees and shrubs that are better adapted for survival, growth, and longevity—including resistance to insects and diseases—in the climate and soils of the Great Plains.

## ***Lincoln lab***

Scientists at the Forestry Sciences Laboratory on the University of Nebraska Campus at Lincoln are conducting studies at the University's Horning State Farm and Mead Field Laboratory in eastern Nebraska; near Hastings in southcentral Nebraska; the Bessey Nursery in northcentral Nebraska; and near Alliance in western Nebraska.

Ralph A. Read, leader of the tree improvement research unit at Lincoln explained that his group is testing conifer provenances with seed collected from trees growing in their natural geographic region. Begun in 1960 in cooperation with the University of Nebraska and the Northcentral Region Tree Improvement Committee, these trials are evaluating Japanese larch, Austrian pine, Scots pine, ponderosa pine, red pine, limber-southwestern white pine, jack pine, Douglas-fir, eastern white pine, pitch pine, blue spruce, Rocky Mountain juniper, and eastern red-cedar.

Provenance testing is revealing several generalized trends. Where species are distributed continuously over a large range in latitude, seed from southern sources is producing trees that are faster growing, less susceptible to late spring or early frost, more susceptible to winter damage, less changeable in winter foliage coloration, and grow later in the fall, than northern sources.

Scientists have identified a number of regions from which superior seed may be obtained. These have been incorporated into the action-oriented Clarke-McNary Tree Distribution Program, which supports the production of forest planting stock for windbreaks, shelterbelts, and farm woodlands.

Specific findings include: a fast-growing source of red pine with desirable crown



*Forestry Technicians John Sprackling (left) and Ted Houland check the growth of a Douglas-fir at the Horning State Farm in Nebraska. This tree was grown from seeds gathered in southern New Mexico.*

characteristics from Quebec, Canada; a fast-growing jack pine source from Ontario (now incorporated into the Clarke-McNary Program); a central Yugoslavian seed source of Austrian pine—fast-growing and highly resistant to *Dothistroma* needle blight; and southern Rocky Mountain origins of Douglas-fir which survive well and grow rapidly in Nebraska.

Preliminary evaluations of ponderosa pine suggest that seed for planting in the eastcentral Great Plains should be collected from northcentral Nebraska. Southern origins of Scots pine—from Turkey and Spain—are recommended for Christmas trees; and fast-growing origins from central Europe with desirable crown characteristics have been identified for windbreaks in Nebraska.

Well-adapted trees identified in the provenance plantations also provide material for further improvement through selection, breeding, progeny testing, and seed orchard establishment. Project scientists have made selections of outstanding Christmas tree and windbreak types from the Scots pine provenance plantation and have established a grafted 10-acre seed orchard containing approximately 1,000 trees. They anticipate substantial seed production in about 5 years.

Project Scientist David F. Van Haverbeke explains that the genetic worth of the best trees is being determined through progeny tests. The tests, in turn, will provide material for recurrent selection, and the establishment of further improved second generation seed orchards.

Improvement of the native junipers is also underway. In cooperation with members of the Forestry Committee of the Great Plains Agricultural Council, a Plains-wide test of selected Rocky Mountain juniper and eastern redcedar seed sources has begun; and a seed orchard program has been started from selections of older trees exhibiting desirable windbreak characteristics, such as tallness and narrowness of crown.

Other Forest Service scientists at Lincoln are working cooperatively with the tree improvement program to develop disease resistant trees for Plains forestry (see the January 1977 issue of *Forestry Research*). The influences of mycorrhizae fungi on tree growth are also being studied.

In addition, cooperating entomologists from Kansas, Nebraska, and North Dakota are studying the biology of damaging insects, and are looking for clues to insect resistant trees.

## ***Bottineau lab***

Working closely with the Lincoln project is the Forestry Practices - Northern Great Plains unit at Bottineau, North Dakota—devoted to an aggressive tree improvement program in the northern Great Plains.

Five-year study results on ponderosa pine have shown that by using a superior seed

source, a 30 percent gain in height growth rate can be achieved without sacrificing cold or drought hardiness.

Results of a 10-year old Scots pine provenance study show that nurseries switching to the best seed sources could gain 20 percent in height growth rate, 5 percent survival rate, and more trees with an aesthetically pleasing dark green color year round. Seed from the next generation may show an additional 10 percent gain in height growth rate.

Two new studies at Bottineau are focusing on adapting green ash and Scots pine for planting in shelterbelts and for other environmental enhancement.



*Sowing Scots pine seeds in styroblocks.*

Research Forester James Van Deusen says "the green ash study is a provenance test in which seeds were collected from throughout the northern Great Plains." The seedlings are being grown in a greenhouse at Bottineau and will be planted as year old stock in the spring of 1979 in North and South Dakota and Nebraska.

The second study is a progeny test of Scots pine. For the past 7 years, Bottineau researchers have been conducting controlled pollinations among superior Scots pine on the Denbigh Experimental Forest in North Dakota.

Van Deusen explains, "we have now accumulated enough seeds to raise seedlings that can be used as progeny tests of the selected parents."





*Scots pine seedlings in the greenhouse.*

The Scots pine seedlings are also being grown in the Bottineau greenhouse and will be planted as year-old stock next to the green ash. The Scots pine plantations will contain about 6,000 trees, the green ash about 6,600.

Final results from these studies may not be available for 20 years, the time it takes for the seedlings to reach maturity, produce seed, and new seedling studies to be initiated.

Researchers at Bottineau are also working on a highly automated greenhouse nursery system that will reduce the time required to grow planting stock. The system centers around containerized seedlings grown under close temperature, humidity, water, nutrient, and root configuration control. Read more about growing containerized seedlings in greenhouses in the upcoming January 1979 issue of *Forestry Research*.

Tree improvement research in the Plains has come a long way since its beginning in 1931 on the Denbigh Experimental Forest. It is now a mature science providing unparalleled opportunities for adapting trees to the Plains environment, and allowing consumers, landowners, and land managers to maintain and improve the economic, protective and aesthetic benefits derived from trees.

For additional information on tree improvement research at Bottineau, contact James Van Deusen, Rocky Mountain Station, Shelterbelt Laboratory, First and Brander St., Bottineau, North Dakota 58318, phone (701) 228-2259, (FTS operator 783-5771).

If you would like more details on tree improvement research at Lincoln, contact Ralph A. Read, Rocky Mountain Station, Forestry Sciences Laboratory, East Campus, University of Nebraska, Lincoln, Nebraska 68503, phone (402) 467-3556, (FTS operator 867-5211).

*—by James Van Deusen and  
David Van Haverbeke,  
Rocky Mountain Station*





*Fire managers carry out a prescribed burn to improve forage production on a ponderosa pine/grass habitat type. Procedures are designed to remove dead grass but not kill the trees.*

# Fire RD&A Program: Research-Land Management Link

**B**right, midmorning sunlight sliced through the trees as Fire Officer Rowen and three companions halted their pickup trucks on Pine Mountain, on a National Forest in Idaho.

Rowen grabbed a notebook, popped a hard hat on his head, and climbed down from the truck. Followed by the others, he headed for an area several hundred yards away.

Rowen checked the papers that were the Fire Use Plan and Report for the Pine Mountain Wildlife Burn. Weather, moisture content of the grasses and forbs, and other conditions met the prescriptions outlined in the Fire Plan. "Okay," he said, "let's go to it."

The four returned to the trucks and began to unload equipment—dictaphone, portable radios, cameras and film, shovels and

pulaskis, and drip torches and fuel. A curious assemblage? Perhaps, but each item was required in their mission to burn 135 acres of the Forest. The men were ready for the crucial phase of a prescribed fire plan to increase forage on an important deer and elk winter range site.

Rowen signaled the three men with torches to begin. Each torchman followed a carefully planned firing pattern as Rowen recorded strategy and fire behavior.

Fact or fiction? The activity on Pine Mountain is fiction, but similar scenes will become fact as land managers include fire as a tool for forest management.

A Fire Use Plan and Report is one of many management tools developed by the Intermountain Station's Fire in Multiple Use Research, Development, and Application Program, headquartered at Missoula, Montana. Created in 1974, the Program's focus is to improve the manager's capability to integrate fire management into land use planning and management activities.

Jim Lotan, Program Manager, says, "The National Forest Management Act showed the way for a change in fire policy. Our approach assumes that fire management exists to support land management programs."

The scope of this approach can be seen in the number of fire-related projects at the Program's center at the Northern Forest Fire Laboratory in Missoula. Scientists and engineers are organized into three teams, each with its own objectives, much like the RD&A Program itself.

Each team is involved with the three main Program goals: (1) define the role of fire; (2) develop methods to integrate fire management into land management planning; and (3) demonstrate and apply developed procedures.

William C. Fischer, leader of the operational planning team, has developed fire use plan and report procedures that land managers can use to apply the concept of fire management.

According to Fischer, a successful prescribed fire is "one that is executed safely, burns under control, accomplishes the prescribed treatment, and attains the management objectives for the area involved."

Fischer's plan and report format are in the Intermountain Station publication "Planning and Evaluating Prescribed Fires . . . a Standard Procedure," INT-GTR-43-FR16.

He and other members of the operational team are responsible for developing techniques for fire management planning as dictated by management objectives.

## *Team provides assistance*

A recent request from the State of Idaho, Department of Lands, fit neatly into their mission. Idaho needed information to help forest managers determine the fire hazard associated with thinning slash, and whether treatment of the slash was needed.

In response to the request, Idaho's Wayne H. Koski and Fischer developed a photo series showing different slash situations created by precommercial thinning in three timber types in north Idaho. Each photo is supplemented by inventory data describing the size, weight, and volume of the debris. Related stand data, estimates of predicted fire behavior, and Idaho Forest Practice Act slash hazard ratings are also given. The publication, "Photo Series for Appraising Precommercial Thinning Slash in North Idaho," INT-GTR-46-FR16, by Koski and Fischer, includes instructions for use in the field.

Other studies by the operational team have produced a catalog and user's guide for describing fire history and weather. They have also developed a guide for wilderness fire management plans and a model to integrate fire into land management planning.

"Modeling and simulation are tools that can help the fire manager project future consequences," says Richard Barney, leader of the RD&A strategic planning and systems development team.

Barney believes the basic decision facing the manager is one of balancing trade-offs between fire use and its control. "Starting with a proposed fire strategy, we estimate fire behavior and effects, and finally, economic consequences. By trying different combinations several times, one strategy should evolve that meets the performance criteria established earlier in the planning process."



Barney and others of his group have designed a fire management decision model; developed a fire effects prediction system; and demonstrated and evaluated a decision model.

The RD&A's rangeland fire management team has concentrated on gathering fire effects information for planning on Bureau of Land Management lands. In 1976, officials of the BLM indicated their interest in applying the fire management concept to lands under their jurisdiction. The resulting cooperative agreement placed BLM's James Linne at the



*Field crew appraises thinning slash to provide information on fire hazard.*

Missoula NFFL, working closely with Program Manager Lotan. Linne has guided efforts to organize published and unpublished forest and rangeland fire information. He and others assigned to the program have also demonstrated how to include fire considerations in forest and rangeland management and have produced guidelines for integrating fire into activity and project level planning.

The Intermountain Station researchers have worked with BLM District teams to develop fire management guidelines for the "Cold Desert," or Great Basin ecosystems.

These guidelines are being tested on three Districts: Elko, Nevada; Cedar City, Utah; and Shoshone, Idaho.

The "Cold Desert" guidelines have also served as the basis for prescriptions for BLM lands in the prairies and the Great Plains. The Bureau selected its Miles City, Montana District to test the guidelines in the Northern Great Plains; the Las Cruces, New Mexico District will test them in the Southern Great Plains.

More than 300 participants attended the "Prairie Burning Workshop" in Jamestown, North Dakota, in April 1978, that launched the Great Plains effort. Participants became familiar with a designated area, applied fire planning principles, and prepared a Fire Use Plan to meet a specified management objective.

Fire has been described as a two-edged sword, bringing death and destruction, yet bearing new life and growth. In some forest environments fire is the essential recycling and decomposing agent, and an important link in the carbon, nitrogen, sulphur, and phosphorus cycles. Fire management recognizes that fire cannot be completely excluded from the forest. Fire is and always has been a part of the ecosystem.

Program Manager Lotan says, "Researchers of the Fire in Multiple Use RD&A Program have ventured beyond control, to management. Land managers have the problems and researchers have a knowledge base. Our program is designed to link the two."

Other publications related to the Fire RD&A Program available from the Intermountain Station are:

Egging, L. T., and Richard J. Barney. 1978. *Fire Management: A Component of Land Management Planning*. Environmental Management 2(6).

Lotan, James E. 1978. *The Forest Service Fire in Multiple-Use Management RD&A Program*. Environmental Management 2(6).

Lotan, James E. 1978. *Why Integrate Fire Management into Land Use Planning*. Environmental Management 2(6).

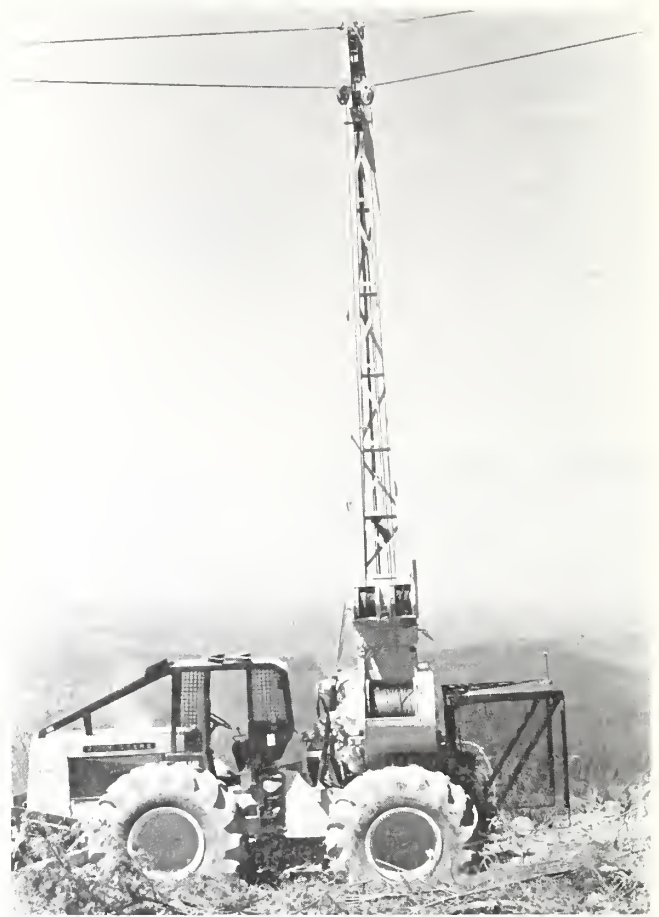
*—by Delpha Noble,  
Intermountain Station*

**B**arney Brady calls it "the best rig I've seen in 35 years of logging." The "rig" is a new, small running skyline yarder. Brady is a logger. He is using a prototype of the new machine to yard timber cut from the Pack Forest near Eatonville, Washington, under a contract with the owners, the University of Washington.

The new yarder was designed primarily to reduce the cost of thinning young stands on steep slopes, yet retain all the environmental advantages of the larger, more expensive running skyline yarders. The design concept is the work of U.S. Forest Service Engineers Hilton Lysons and Charles Mann of the Pacific Northwest Forest and Range Experiment Station's forest engineering research unit in Seattle, Washington.

The technology for removing logs from steep slopes with minimal environmental damage has been steadily improving since the running skyline yarder was introduced in the mid-1960's. With a running skyline, three suspended lines are moving and, when properly tensioned, support and control the carriage and log load. The strength of cable required is about half that of cable in equivalent standing skylines, which support the carriage and log load by a single, fixed cable.

The running skylines currently in use have proven efficient and economical for



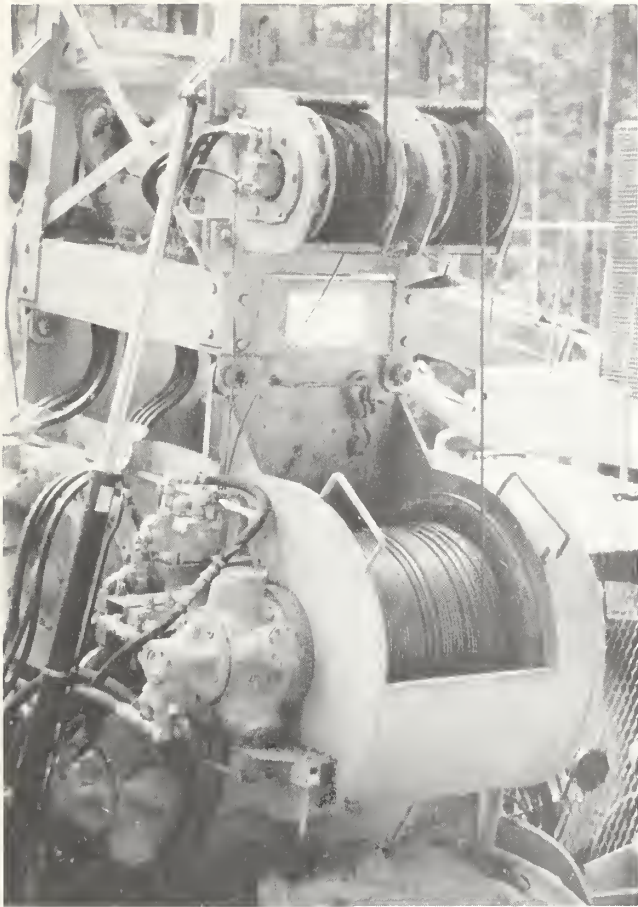
*The pee wee yarder shown in operation at Pack Forest, Spring 1978.*

## A New Yarder for Small Timber

yarding large and medium sized logs from both clearcuts and partial cuts. But the yarding of small, lower value logs has presented a critical cost problem. The revenue from small logs has not always been enough to pay the cost of owning and operating

conventional yarding equipment. Other, less efficient, yarding systems for moving small logs often caused unacceptable environmental damage. Because of the cost crunch, most young stands of timber on difficult sites have gone unthinned.





*Innovative hydraulic drum drive mechanism is key to success of the peewee yarder. Although developed for the peewee yarder, it can be adapted to other yarding systems.*

The peewee yarder is expected to solve the cost problem.

"We have used a new concept in hydraulically powered, interlocked drums to control the speed at which the cables are wound on and off the drums," says Lysons. "This eliminates the need for clutches and brakes, simplifying operations and reducing costs. Two levers provide smooth, simple control of all yarding functions. This greatly improves efficiency and reduces damage to the residual stand in a thinning operation," he explains.

It takes only three people to operate the new yarder. It is called the "peewee yarder" because it handles logs from 5 to 20 inches in diameter. Loggers have traditionally called

these "peewee" logs because they were considered insignificant compared with logs from the large old growth timber.

But now logs of this size are far from insignificant and can be processed in a growing number of mills. In the Pacific Northwest there are millions of acres of conifer stands 35 to 80 years old, and that acreage will increase as the old-growth timber is cut. Perhaps one quarter of these young trees grow in overly dense stands on fragile soils or on steep slopes. Thinning these stands could make use of wood that is otherwise lost as trees die and might increase the fiber supply as much as 20 percent in volume on a continuous basis.



*Contract logger Barney Brady demonstrates the use of the control panel, easily operated by one person.*

*Three-man crew can handle all jobs involved in a thinning operation.*



*Long narrow harvest corridor is used for thinning operation on steep slopes. Slack-pulling carriage enables logs to be yarded into the corridor from as far as 75 feet into the timber.*

As Brady has used the prototype to yard timber from clearcuts and partial cuts, his progress and production have been followed carefully by the yarder's designers and builders.

In six weeks in early 1978, Brady and two assistants yarded logs thinned from a mixed stand of Douglas-fir and red alder to an existing road from 14 settings 150 feet apart. Two settings were yarded downhill, 12 uphill. With line speeds of 750 feet per minute, Brady brought logs to the side of the road at a rate of 30 to 50 per hour. Four logs make up the usual load. The slack-pulling carriage allows reaching logs as far as 75 feet from the 12-foot-wide yarding corridors. These corridors may extend up to 1,200 feet between yarder and tailback.

## ***Advantages***

Because the peewee yarder has controls mounted on the rear of the vehicle instead of inside the cab, Brady is also the "chaser." After he brings the logs to the edge of the road, he leaves the yarder controls long enough to unhook the 8-foot chokers from the logs. Yarding, loading, and hauling can be streamlined into one continuous operation when enough logs are available.

Moving the yarder is easy and fast. Unhooking the simplified rigging, moving to a new setting, and rigging up to yard again takes less than an hour. The yarder is mounted on a conventional 110-horse-power rubber-tired skidder. This is essentially an off-road vehicle and can be easily driven on steep, narrow mountain roads. The 37-foot tower that suspends the cable can be lowered to a horizontal position for travel, but this is



*Ends drag the ground minimally or are lifted free.*



unnecessary for short moves. For long highway moves it must be carried on a truck.

In addition to its special features, the peewee yarder has all the environmental advantages of the larger running skyline yarders. These mobile, cable systems can be used to yard logs both uphill and downhill, thus fewer roads and landings are needed. Less construction means less soil and water disturbance and reduced impact on fish and wildlife habitat. Because the logs are suspended at one end during yarding, there is less soil disturbance. Log breakage and damage to standing trees are also reduced.

The running skyline system also offers economic advantages over larger, less mobile systems. Fewer roads and smaller landings are needed. Less land is removed from timber production. The mobility of the equipment makes it practical to log smaller, irregular, and scattered units either by thinning or clearcutting. The peewee yarder retains and extends these economic advantages.

The peewee yarder is the result of cooperation between researchers and private industry. The three-drum set for the prototype was designed and built by Lantec Industries, Ltd. of Langley, British Columbia. The yarder tower was designed by the Applied Physics Laboratory of the University of Washington, which was also responsible for assembling the entire mechanism on a tractor-skidder on loan from Deere and Company of Moline, Illinois. Before the operational trials began, the Applied Physics Laboratory conducted extensive instrumented tests to check out the mechanical systems.

Even though the peewee yarder passed its early tests with flying colors, additional evaluation was done during the summer of 1978. The prototype yarder was kept working steadily to determine its mechanical integrity. Performance evaluations were made under a variety of operating modes—uphill and downhill thinning, clearcutting, slash removal, yarding on flat ground with wet or sensitive soils, and two-stage yarding.

As more sawmills develop the capability to process small logs, the demand for yarders of this type is expected to increase. Lyson says, "Several U.S. manufacturers and researchers in foreign countries are following

developments closely. The yarder has potential use in all forested regions where small logs must be yarded from steep slopes or sensitive soils."



*At the landing, the logs are lifted onto a truck.*

*Photos by Dorothy Bergstrom and Summer Walters.*

Evaluation and demonstration of the yarder has been under the direction of Ed Clarke at the Pacific Northwest Station's headquarters in Portland. Those who want additional information about the peewee yarder can write to him there at P.O. Box 3141, Portland, Oregon 97208.

*—by Dorothy Bergstrom  
Pacific Northwest Station*



*Researchers are experimenting with the use of growth inhibitors to control brush on fuelbreaks.*

# Developing Alternatives for California's Chaparral

**T**ough, shrubby plants that are known as chaparral blanket mile after mile of southern California wildlands. One of the major problems in managing these vast, dry fields of chamise, ceanothus, and similar species is that they are highly flammable. Most stands burn every 20 to 40 years; the largest of these fires can cost as much as \$15 million in suppression expenses and post-fire damages. When the fires are out, the trouble is not over.

Coarse soil, no longer held in place by vegetation, slides off steep slopes. Winter rains, falling on burned-over watersheds, usually result in floods that move great quantities of sediment downstream to reservoirs, over roads, and into houses.

With these problems, it is no wonder that the predominant approach to managing chaparral in southern California has been to view the brush mainly as watershed cover.



The effort to protect brush from wildfire has led to an emphasis on fire suppression at the expense of other land-use concerns. It has also contributed to a dangerous and unnaturally heavy buildup of dead fuels.

As a way out of this predicament, some managers have attempted to reduce chaparral fuels by mechanical, biological, or chemical means. These and other approaches to managing chaparral are being studied by Pacific Southwest Station researchers in the

Chaparral Management Unit at Riverside and Glendora, California. The Unit is part of the Chaparral Management Research and Development Program, a 5-year effort in which information produced by the researchers will be tested and demonstrated at selected sites throughout southern California. Program administrators will also work with the researchers to produce a series of field guides, handbooks, and other materials that highlight the research results that are ready for use.

The research is based on the premise that once fuel management programs are developed and put into effect, the fire-flood problem will not loom as large, and managers will be able to devote more time and money to provide a variety of uses from the brushfields. The Program will produce needed information on managing chaparral for recreation, forage, and wildlife habitat as well as for watershed values. Findings should be of interest to land managers in chaparral sites throughout California, Oregon, Nevada, Idaho, and the American Southwest. In the four regions of the world—central Chile, Australia, the Mediterranean countries, and South Africa—where climate and vegetation are similar to southern California's, the research results should also be helpful.

## *Inventory, classification*

To aid intensive chaparral management, researchers are developing better ways to inventory chaparral land, to classify inventoried areas on the basis of vegetation, soils, terrain, and other major features, and to handle data so that inventory information is convenient for administrators and resource specialists to use and update.

The classification scheme now being developed will be compatible with some of the existing regional and national classification systems but will be more specific to chaparral. The system will be dynamic, and will reflect not only the state of the land, but also plant growth and succession, and other natural changes.



*Satellite imagery may be an aid in classifying chaparral land.*

## ***Fuel modification***

Grazing, prescribed fire, and use of herbicides are currently being evaluated as methods for reducing fuels. Depending on site, species, and age, chaparral stands may have 10 to 40 tons of fuel per acre, or more. In the grazing study, a herd of Spanish goats is browsing brush along fuelbreaks and other sites on the Cleveland National Forest. Experiments during the past 2 years have shown that free-grazing goats prefer birch-leaf mountain mahogany and scrub oak—two commonly occurring species. They browsed these plants heavily when allowed to feed freely in 5-year-old regrowth. If the goats were tightly fenced, they browsed the less palatable species—chamise, Eastwood manzanita, and California buckwheat.

Prescribed burning—the use of fire under safe, carefully controlled conditions—has not been used to its full potential as a way to lighten loads of chaparral fuels in southern California. One of the major research goals is to provide the information managers need to develop safe, effective, and economical prescriptions for burning.

Other work is describing the sequence of vegetation that occurs following wildfires or prescribed burns. In one study, for example, plant composition and growth on sites burned by wildfire were closely monitored for 3 years after fire, and will be monitored again during the 10th through 12th post-fire years. This information will be compared with that from sites burned by prescribed fire under various conditions, to see if the recovery sequence differs.



*Goats grazed almost all of the brush on this plot, except for that within the 25-square-foot exclosure.*



## **Brushland Hydrology**

Studies of brushland hydrology are aimed at determining natural erosion rates on southern California watersheds, and identifying the effects prescribed burning, grazing, use of herbicides, and other management activities have on erosion, sedimentation, and water yield. This work includes participating in an interagency investigation of sediment management. This study, which is headed by the California Institute of Technology, Pasadena, encompasses mountain watersheds as well as the coastal plains and beaches that are affected by upland sediment. The Experiment Station's portion of this study includes analyzing chaparral watersheds to determine how fire affects the delivery of sediment to sites downstream.

As in most of the chaparral studies, one goal is to develop mathematical models that simulate natural processes, in this case, erosion. Managers will be able to use these models to predict the erosion that may result from different management activities.

Research on hard-to-wet soils will provide information about the distribution of these soils and their potential impact on erosion and sedimentation. Hard-to-wet soils, formed either during fires or by other processes, block the percolation of rainwater, thus increasing runoff and erosion.

## **Nutrient budgets**

Another concern is the long-term effects that management activities—particularly prescribed burning—might have on the bacteria, fungi, and other soil microbes that provide nutrients for chaparral plants. Prescribed burning, while it may release nutrients that are tied up in dead plant material, may also destroy other nutrients and kill some beneficial soil microflora. Current studies are defining the effect of fire on the cycling of nitrogen, a nutrient that is in low supply in most chaparral stands.

Soil microbes are also of interest because changes in the size and composition of microbial populations might be a factor

behind the aging of chaparral. Most experts agree that by the time a chaparral stand reaches 30 to 40 years of age, it is putting on little new growth; more than 50 percent of the plant material in the stand may be dead. The fire hazard in these decadent stands is much higher than that in younger brush. Researchers are trying to determine if increased availability of nutrients will slow down the aging process. One study has shown that nutrient cycling in a 15-year-old stand was much more efficient than in either a 54-year-old or a 1-year-old stand. This information, along with data from followup studies, will be useful in determining how prescribed fire can be used to improve the nutrient cycling process.

## **Oak management**

Native oaks, which provide food for wildlife, shade for recreationists, firewood for homeowners, and a break in the monotony of the brushfields, are one of the newest subjects of the team's research. Studies are aimed at developing guidelines for managing the vast oak-woodland resource in California.

One project will show the response of various oak species to fire. This work will provide managers with the information they need in order to know whether oaks damaged by fire have been killed and should be removed, or if the trees will recover. Preliminary evaluations of oak sensitivity to fire have shown that, among the five species studied, coast live oak (*Quercus agrifolia*) is the most fire-resistant. This species can resprout from the crown within 2 months after being totally blackened by fire. It is followed by California black oak (*Quercus kelloggii*), canyon live oak (*Quercus chrysolepis*), and interior live oak (*Quercus wislizenii*). California scrub oak (*Quercus dumosa*) is the least fire-resistant.

To determine other oak management problems that need study, the researchers sponsored an informal workshop on southern California oak management this year, and will hold a formal symposium on the topic in 1979.



*Bark characteristics of native oaks — such as this valley oak — will be used as the basis for a new guide to identifying these species.*

## ***Smog damage***

Other research focuses on the impact of smog from heavily populated areas of southern California. While smog apparently has not damaged chaparral, it has injured conifers in the mountains above the brushlands. The Station's studies in the San Bernardino Mountains, which are one of several mountain groups that receive much of the smog produced in the Los Angeles basin, have shown that ponderosa pine and Jeffrey pine are severely affected by air pollution, while sugar pine seems smog-resistant.

Current studies will show how different doses of air pollution affect tree growth and susceptibility to attack by insects and diseases, and will produce guidelines for managing smog-damaged stands.

## ***Future research***

The group plans to start studies in two other areas of chaparral management—treatment of the riparian zone and maintenance of wildlife habitat. Riparian, or streambank, vegetation makes up only about 10 percent of the chaparral landscape. However, it receives nearly 90 percent of the recreation and wildlife use. This zone requires special attention because it is affected by brushland treatments, whether or not they extend into the riparian zone itself. Plans call for studies on how to manage riparian vegetation to control sediment, maintain wildlife habitat, and preserve the zone's esthetic values.

Wildlife habitat studies will identify the effects of chaparral management on the density and diversity of wildlife species. Currently, Station scientists are coordinating research by cooperators. Included is a study on the recovery of insect, reptile, songbird, rodent, and other small mammal populations following wildfire; and the development of charts and brief reports summarizing habitat needs for more than 100 species of birds, reptiles and amphibians, and mammals.

The Chaparral Program is probably the most comprehensive effort yet made to learn more about the functioning and management of southern California's chaparral ecosystem. While this effort may not solve all the management problems, it will reduce their impact on the more than 10 million southern Californians whose lives are affected by chaparral lands.

*—by Marcia Wood,  
Pacific Southwest Station*

*NOTE: Details about this research are available from Gene Conrad, Leader, Chaparral Unit, PSW Station, Forest Fire Laboratory, P.O. Box 5007, Riverside, CA 92517; phone (714) 787-1551, or FTS: 796-1551.*



# Publications



## Visitors surveyed on use of self-guided nature trail

A California survey of vacationers at a self-guided nature trail provides information about what people do—and do not—learn on outdoor walks. The study site was the Rainbow Trail on the Eldorado National Forest in northern California. The trail is located about 500 feet from Lake Tahoe, and one of the primary purposes of the walk is to teach visitors about water quality and water management in the Lake and surrounding basin. The trail takes visitors through a forest meadow and alongside Taylor Creek, one of the more than 60 streams that flow into the Lake. The trail also leads to the Stream Profile Chamber, a unique building in which visitors can get an underwater look, through large windows, at a cross-section of Taylor Creek.

For the survey, 234 adult visitors were observed as they walked along the trail, and were asked to participate in a short interview just before they left the site. Results showed that learning was generally greater for the more educated, physically active visitors who took their time and participated in suggested activities, such as checking how long it takes for a gallon of water to flow over a small dam. One of the most frequently mentioned trailside lessons was about the function of snow pillows. A short quiz during the interviews proved this out—62 percent of the visitors correctly remembered the function of snow pillows. Disappointingly, the question that received the lowest number of correct answers—18 percent—was the one dealing with the effect of water quality on the reproduction of the Kokanee salmon and other fish that spawn in Taylor Creek.

Trail officials, however, were generally pleased with the amount of information that the visitors absorbed, and the visitors themselves seemed to enjoy their stay. More information is in the report, "Response of visitors to the Rainbow Trail: an evaluation of an interpretive area in the Lake Tahoe Basin, California," Research Paper PSW-131-FR16, by Richard A. Kuehner and Gary H. Elsner. Copies are available from the PSW Station.

## A new insect book

Foresters now have the insect reference book they asked for a few years ago. *Western Forest Insects* by R. L. Furniss and V. M. Carolin is a completely revised and enlarged replacement for F. P. Keen's classic USDA handbook, *Insect Enemies of Western Forests*,

which has been out of print for several years. The new book is based on the published literature about insects and related organisms that live on trees, shrubs, and wood products in North America west of the 100th meridian and north of Mexico.

The book is about insects as they relate to the multiple uses of the forest, a concept that was shaped by practicing foresters and entomologists around the western United States, through interviews with Furniss before the project was started.

Insects that cause significant damage to forest resources are emphasized. A table lists 31 species of major insect pests by four broad geographic regions. Other species are lesser pests which have only local impact on forest or product values. Most of the 1,400 species described are considered beneficial or innocuous.

The book is organized so it is useful for insect identification and as a source of information about insects known to the reader. The general index lists both scientific and common names, with the most important page references in bold type. An asterisk indicates whether there is an illustration.

Those who want to identify an insect can use the Diagnostic Host Index. With it, the reader looks first under the plant species involved, then under the part of tree or shrub infested, and finally under the feeding habits, where insects that might cause the observed damage are listed. Possible culprits are then located in the major sections of the book, where insect species are listed in taxonomic order, described, and illustrated with 500 photographs. Readers who need additional information should consult the 1,200 references cited.

An introductory section provides background information on forest insects and their environment. There are chapters in non-technical language on

the role, natural regulation, habitat relationships, prevention, and control of insects.

Students, extension specialists, technicians, forest owners, and others should find the manual useful.

The book was published by the U.S. Department of Agriculture and is available from the Superintendent of Documents in Washington, D.C. (Stock No. 001-000-3618-1, price \$8.75). The authors are entomologists, now retired from the staff of the Pacific Northwest Station.

## **Spruce beetle in the Rockies**

A report summarizing available knowledge on the spruce beetle in the western United States has been published by the Rocky Mountain Station.

Its main purpose is to assemble pertinent information under common binding so that foresters and land managers can easily find answers to their questions on the beetle.

While "Spruce Beetle in the Rockies" is primarily concerned with the beetle in the central and southern Rockies, recent work in the northern Rockies and Alaska is also reviewed. The literature from the Rockies is mostly derived from studies in Colorado where spruce beetle research was emphasized following an outbreak on the White River National Forest in the 1940's. That epidemic destroyed 3.8 billion board feet of spruce timber.

The report details the life history and behavior of the spruce beetle; host relationships; effects of temperature and biotic factors on the beetle; effects of



infestations on watersheds, forage production, wildlife, wood products, etc.; and discusses detection, evaluation, and suppression. The suppression section covers the current status of chemicals, pheromones, trap trees, and silvicultural treatments. The initial steps in controlling spruce beetle populations are stated in the final section on beetle management policy.

If you would like a copy of General Technical Report RM-49-FR16, write the Rocky Mountain Station.

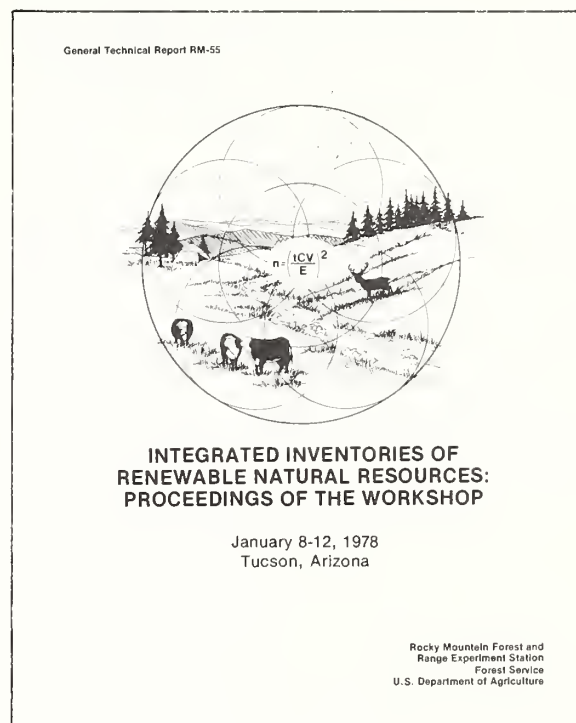
## Inventories proceedings published

The Society of American Foresters, University of Arizona, U.S. Forest Service, Bureau of Land Management, and the Renewable Natural Resources Foundation sponsored the Integrated Inventories of Renewable Natural Resources Workshop in Tucson, Arizona, on January 8-12, 1978.

The workshop was held to promote development of efficient, objective, and timely systems for making integrated inventories of multiple resources.

The 82 papers presented were quickly published in "Integrated Inventories of Renewable Natural Resources: Proceedings of the Workshop," General Technical Report RM-55.

Participants looked at present procedures for collecting data on individual resources. The need for collecting data through an integrated process at various interest levels was also examined. Various land and vegetation classification schemes, remote sensing opportunities, statistical considerations in integrating



inventories, and available data processing packages and systems were reviewed. Finally, a group of state-of-the-art papers summarized progress being made toward developing integrated inventory procedures.

The material contained in these proceedings supplements those of the Inventory Design and Analysis Workshop held in Fort Collins, Colorado in 1974, the Systems Analysis and Forest Resource Management Workshop held in Athens, Georgia in 1975, and the Resource Data Management Symposium held in West Lafayette, Indiana in 1976.

Copies of the proceedings were distributed in April to all Forest Service Regions, Stations, and most libraries throughout the country. Additional copies are now available for \$15.00 from National Technical Information Services, 5285 Port Royal Rd., Springfield, Virginia, 22161. Request No. PB281036.

## **An Alaska plant guide for amateur botanists**

A guide to the more common plants of the hemlock-spruce forests of southeast Alaska has been published by the Pacific Northwest Station. Forty-one species of clubmosses, ferns, herbs, and shrubs are described and illustrated. An identification key and a glossary of technical terms are included. The guide was designed primarily as a tool for foresters, but it will be useful to anyone visiting or working in southeast Alaska.

Single copies of "The Common Plants of the Hemlock-Spruce Forests of Alaska," by O. Wayne Robuck are available from the Pacific Northwest Station as long as the supply lasts. Quantity orders must be sent to the Superintendent of Documents, U.S. Printing Office, Washington, D.C., 20402. Order by Stock No. 001-001-00432-4. The price is \$2.75.

## **For the birds**

The forest manager's key role in managing habitat for nongame bird species was the subject of a workshop held in Portland, Oregon, in February 1977. The workshop was the first in a planned series of regional meetings to present the principles and techniques of nongame bird management to managers at all levels.

Proceedings of the workshop are now available. The 12 papers presented discuss the importance of birds in forest ecosystems and the nongame bird communities in the western U.S. The plant

communities and successional stages that supply the habitat for these bird communities are also described. Several papers discuss the impact of silvicultural and other forest and range management practices and land uses on bird habitat. Others present guidelines for managers.

Copies of "Proceedings of the workshop on nongame bird habitat management in the coniferous forests of the western United States," by Richard M. DeGraaf, Technical Coordinator, (General Technical Report PNW-64) are available from the Pacific Northwest Station.

## **Pipeline moves wood chips**

A new process to move wood chips by hydraulic pipeline could save time, money, and energy. The process was developed under a cooperative study between the Intermountain Station and Montana State University, Bozeman.

Studies show the pipeline system could significantly reduce the costs of transporting large volumes of chipped wood residues to pulpmills or other processing or shipping points. The concept has potential for wide application—there are no distance, terrain, or weather constraints. Energy-efficient characteristics make the system especially attractive. Tests show that transporting wood chips by hydraulic pipeline could save 50 percent or more over present methods.

Dr. William A. Hunt, leader of the pipeline project since it began in 1963, is a professor in the Civil Engineering and



Engineering Mechanics Department of Montana State. He has been assisted by Rulon B. Gardner of the Intermountain Station's Forestry Sciences Laboratory, Bozeman.

In 1976, Gardner presented the results of the study to an international symposium on transport and handling in the pulp and paper industry, in Rotterdam, Netherlands.

Further information on the pipeline study is included in the publication, "Transporting Woodchips by Hydraulic Pipeline," INT-R-530-FR16, by Rulon B. Gardner.

## Wildlife benefits from wildfire

Since the advent of organized fire protection shortly after the turn of the century, the policy has been to extinguish all wildfires as quickly as possible and to report damages caused by each fire. The USDA Forest Service prepares an Individual Fire Report for each reportable fire, which includes acres burned and estimates of damage to resources.

Although there are damages, sometimes serious ones, benefits also are apparent when fire effects are evaluated on short- as well as long-term bases.

In an effort to look at both sides of the ledger, a cooperative study was begun in 1974 between the University of Arizona and the Rocky Mountain Station. Results of this study have just been published in "Determining Potential Wildlife Benefits from Wildfires in Arizona Ponderosa Pine Forests," General Technical Report RM-51-FR16, by Philip O. Lowe, Peter F. Ffolliott, John H. Dieterich, and David R. Patton.

The study took place on four burned areas, 1, 3, 7, and 20 years old, near Flagstaff, Arizona.

Although wildfires destroyed or damaged the timber resource, the study showed that other resources benefited.

If you would like more information on this study, write the Rocky Mountain Station for a copy of this report.



Watch for the January issue. It will feature: Rehabilitation Problems in Alpine Regions; Growing Containerized Seedlings in Greenhouses; WEST-FORNET and Its Services: Relationships between Mycorrhizae and Small Animals, and more.

If you know of someone who would be interested in this publication, he or she can be added to the mailing list by filling out the coupon below and mailing it to us.

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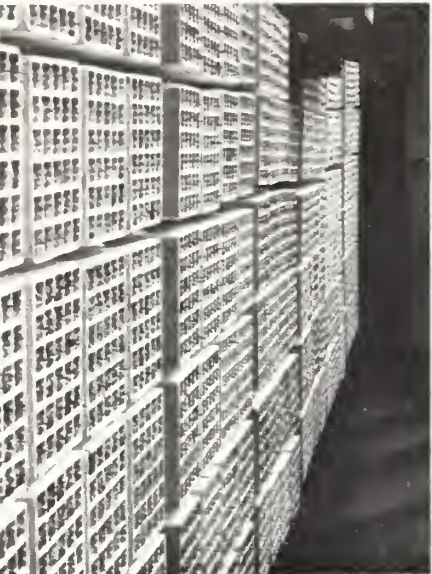
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